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BONNET'S THEORY OF EVOLUTION.

A SYSTEM OF NEGATIONS.[1]

"Truth emerges sooner from error than from confusion."—*Bacon*.

BONNET'S theory of evolution, it is well known, was radically different and even diametrically opposed to the theory of evolution as now commonly held; it was an absolute denial of new-formation, or epigenesis, and was based upon the idea of preformation in the sense of instantaneous original creation. This is an historical fact which should not be obscured by the distinction which has lately arisen between those who maintain and those who deny the inheritance of acquired characters—between the Lamarckians and the Weismannians. The new idea of preformation opposes only that one-sided epigenesis of recent date which insists that all true epigenesis is from without, and that all generation from within must bear the name "evolution." The distinction serves to set off the extreme Lamarckian school; but it is quite modern, and not opposed to the idea of true generation. There are, nevertheless, some biologists who imagine they see in certain recent theories of development a renascence of Bonnet's evolution theory. Are they not aware of the fundamental difference between the old and the new standpoints? Yet some of the advocates of epigenesis maintain that these distinctions vanish when we compare Bonnet's latest views with those now held by modern evolutionists. This claim has often been repeated of late, and I am aware that it is backed by eminent scientists, for whom I have the very highest respect. Among them is a no less revered authority than Professor Huxley, from whom I should not venture to differ except for reasons that seem indubitable.

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[1] From the "Biological Lectures" at the Marine Biological Laboratory, 1894.

If Bonnet's theory of evolution had in it a truth of such vitality that it can rise, phœnix-like, from the ashes of its supposed demolition; or, to state it in a more conventional form, if our theories of development are carrying us back to the standpoint reached by the evolutionists of last century, it is a matter of more than historical interest. The issues that now lead embryological research are involved. Our ideas of development, the landmarks already passed, the cardinal points in our present horizon, our tendencies are all brought under the rubrics of comparison. Any mistake here must obscure the general situation in just those points where it most needs to be clearly defined.

Our chief concern is with standpoints. Compared with them, theories are of little consequence. The standpoint sets the limits to our horizon, and so determines the reach and range of vision. It is the vantage-ground of progress, the conquest of laborious research, of which one might say, as Johannes Müller once said of his own work: "*Es klebt Blut an der Arbeit.*" We have to deal, then, with a question of moment, and one which presents, in addition to its inherent difficulties, the obstacles raised by prejudgment. Let us try to clear the ground a little, so as to get into closer touch with the question.

One fact orients the whole field. It is the fact that we now build upon two broad truths which found their negation in the old theories of development, namely, *heredity* and *generation.* It may sound a little paradoxical, but it is true, that the two theories of last century not only contradicted each other, but also denied the very truths they came to explain. Evolution was the absolute negation of both heredity and generation, while epigenesis upheld generation, but denied organic continuity, the essential foundation of heredity. Let us make no mistake on this point, for it is fundamental and decisive as regards standpoints.

Both Bonnet and Haller boldly denied the possibility of generation. Why? For the obvious reason that generation meant epigenesis. There was no middle ground. If by any possibility anything of an organic nature could be referred to epigenesis, the miracle of creation would be reduced to the level of an every-day occurrence. The backbone of the argument for *original* preformation would go to pieces if a single vertebra could arise epigenetically. Not so much as a supernumerary digit, or a monstrous organ of any description, troublesome as such things were to the preformationist, could be allowed to pass to the credit of epigenesis. Allow that a single organ can be formed anew, and the whole edifice of preformation would be irretrievably undermined. Bonnet saw the bearings and the perils of his theory, and he did all that ingenuity could do to guard the central idea against hostile attacks.

What that central idea was, and how the fate of the whole theory hung upon it, Bonnet makes clear in one of his earlier writings. Referring to the principles advanced in relation to the formation of the mule, Bonnet makes the following remarks, "prophetic of the event" already fulfilled on his own head:

> "They [the principles] will always rest on *the importance of the pre-existence of the germ to fecundation. I admit, then, that if the falsity of this observation should ever be demonstrated, the edifice I have attempted to erect on that basis would be as ruinous as those I have undertaken to destroy.* Such is the natural fate which threatens analytical works; if we can but destroy the fundamental principle, and detach the main link from the chain, the whole work will be little more than a series of propositions which are more or less erroneous, and it can be looked upon in no other light than as a mere romance."[1]

That "the *pre existence of the germ to fecundation*" meant to Bonnet the pre-existence of a *completely formed* organism, and hence the denial of generation, is expressly stated in a previous paragraph.

> "Mais si le germe préexiste à la fécondation, s'il n'est pas *engendré*; si des parties qui ne paraissaient point du tout exister *existaient réellement*, n'est-il pas fort probable que l'organe de la voix du mulet n'est pas engendré non plus?" (*Ibid.*, p. 59.)

Such is the burden of the argument throughout. Indeed, no one doubts that Bonnet *began* with a preformation so complete as to exclude generation, and that this idea was the centre around which the whole of his philosophy at first revolved. Did he ever abandon the idea, or modify it in such a way as to nullify the original distinction between his doctrine and epigenesis? Did he knowingly, or by any inadvertence, ever once drop the bars to epigenesis? If he did, then there may be some truth in the current opinion that the new evolution is a revival of the old idea as it was finally left by Bonnet. If he did not, either directly or by implication, then there can be no foundation for such an opinion. I believe this opinion is erroneous, and that it leads to confusion that is wholly mischievous.

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[1] Preface to his *Contemplation of Nature* (1764); finally published as *Tableau des considérations*, as an introduction to the *Palingénésie philosophique*, Art. XII, p. 62 (1783).

What Professor Huxley has said on this point must be carefully noted, as I suspect that some writers have taken his words in a sense that somewhat betters the instruction.

After pointing out that the hypothesis of *emboîtement* is to be carefully distinguished from the hypothesis of evolution of a germ containing in miniature all the organs of the adult, Huxley makes the following statements:

> "While holding firmly by the former, Bonnet more or less modified the latter in his later writings, and, at length *he admits that a 'germ' need not be an actual miniature of the organism; but that it may be merely an 'original preformation' capable of producing the latter.*
>
> "But, thus defined, the germ is neither more nor less than the *'particula genitalis'* of Aristotle, or the *'primordium vegetale'* or 'ovum' of Harvey, and the 'evolution' of such a germ would not be distinguishable from 'epigenesis.'"[1]

Observe that Huxley does not here authorise the opinion that "evolutionists" are reviving the objectionable features of Bonnet's system. There is no suggestion of a retrograde movement on the part of embryologists. Indeed, it is very clear that Huxley saw in modern embryology the verification of the main contention of epigenesis, and the repudiation of both of Bonnet's hypotheses. But while claiming for epigenesis, a complete victory over the doctrine of evolution as understood in the eighteenth century, Huxley takes care not to sanction the idea that epigenesis contains the whole truth. In fact, he makes a suggestion that, to my mind, outshines "the divination of genius" ascribed to Harvey. The words already "proved a prophecy" are the following:

> "*It is not impossible that, when the analysis of the process of development is carried still further, and the origin of the molecular components of the physically gross,*

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[1] Article "Evolution," *Encycl. Brit.*, p. 745; *Darwiniana Essays*, 1893, p. 193.

though sensibly minute, bodies which we term germs is traced, the theory of development will approach more nearly to metamorphosis than to epigenesis." (*Ibid.*, p. 283.)

The movement here anticipated is not in the direction of the old evolution, but towards a view which represents the residual truth of both "epigenesis" and "metamorphosis." That part of the old epigenesis which started the germ as "*a sort of living precipitate*" *in a clear fluid* ("colliquamentum"), is of course set aside, and along with it the absurdities of Bonnet's idea of metamorphosis (change of external form without change of structure or substance).

In place of these errors are put the ready-made germ, with a structure received from the parent organism, impregnation by fusion of two germs, and development by a process of division. Evolution is viewed as:

> "A course of progressive differentiation."
>
> "A succession of changes of the form, structure, and functions of the germ by which it passes, step by step, from an extreme simplicity, or relative homogeneity of visible structure, to a greater or less degree of complexity or heterogeneity." (*Ibid.*, p. 199.)

Huxley says:

> "From this point of view the process which, in its *superficial aspect* is epigenesis, appears *in essence* to be evolution, *in the modified sense adopted in Bonnet's later writings*; and development is merely the expansion of a potential organism, or 'original preformation,' according to fixed laws." (*Ibid.*, p. 204.)

The position here, so concisely sketched in 1878, is the one toward which opinion seems to be drifting. But while the philosophy is clear, the identification of it, or any part of it, with Bonnet's later views is, I believe, unwarranted by anything contained in Bonnet's writings. The comparison, if it be inadmissible, is all the more unfortunate for the sanction of an authority so universally respected. It has been taken for considerable more than its author would probably approve; for some have construed it against epigenesis, and others against evolution.

We should have no fault to find with the comparison if it were true, as Huxley seems to have supposed, that Bonnet finally adopted a definition of the germ which dropped the chief distinction between evolution and epigenesis, as understood in his time. I do not find any such inconsistency between Bonnet's earlier and later definitions, and it is very certain that Bonnet never made any concession which, to his understanding, weakened in the least degree his idea of preformation. Is it probable that Bonnet tripped on so fundamental a matter without knowing it? Is it not more probable that Professor Huxley has put an interpretation upon his words which he would have most emphatically disputed? Is not the suicidal concession imputed to Bonnet, after all, merely an inference to which his words were liable, only when isolated from the context and construed to the mind of the reader rather than to the intention of the author?

Although the words "evolution in the modified sense adopted in Bonnet's later writings," might suggest, if they do not distinctly imply, that Bonnet finally resigned himself to a view hardly distinguishable from epigenesis; still I am inclined to think that Huxley only intended to hold Bonnet responsible for a definition, himself alone responsible for the conclusion supposed to be involved in it.

PRIMARY HYPOTHESES OF BONNET'S THEORY.

We might appeal at once to Bonnet's definitions of germs; but it will be better, I think, to consider first the general principles and bearings of the theory as a whole, reserving the definitions to be examined in the light of the ideas underlying them. Let us see what were the primary hypotheses of Bonnet's system of philosophy. Huxley has already pointed out the distinction to be kept in mind between *emboîtement* and *preformation*. These two hypotheses do not stand alone, however; neither are they of equal importance. Preformation, as I have already said, was the central idea—the very heart of the whole system of hypotheses—just that part, in fact, on the maintenance of which hung the life and use of all the other parts, and which was, therefore, most carefully guarded. Other parts could be modified, supplemented, or even wholly abandoned, if need be; but whatever the changes adopted, they were always measured to the necessity of keeping the preformation idea inviolate.

The doctrine of *emboîtement,* although regarded by Bonnet as "one of the greatest triumphs of the mind over the senses," and although filling a very conspicuous place in his speculation, was yet only an auxiliary hypothesis, to be used or laid aside at convenience. Its prominence, as a butt of ridicule, has thrown its companion hypothesis quite into oblivion. I refer to the hypothesis of "the *dissemination of germs,*" which Bonnet always held in reserve for emergencies not provided for in "*emboîtement.*" This hypothesis underlies no inconsiderable part of Bonnet's philosophy, and figures prominently in his ideas of regeneration and propagation by buds and slips. The more important modifications of views on the germ are connected with this same hypothesis.

We have, therefore, to recognise three primary parts in Bonnet's theory, namely, *preformation* (of the adult organism with all its essential parts), *emboîtement* and *dissemination,* and to bear in mind that the first stood as principal, the second and third as ancillaries. The latter, as employed by Bonnet, had no use or meaning, except to affirm and sustain the former. Holding firmly to *emboîtement* and dissemination and abandoning preformation would be a monstrous self-stultification. To this it may be replied that no one has charged Bonnet with complete abandonment of the idea of preformation, but only with a modification of his definition of the germ. But a modification that reduced "evolution" to a point where it could no longer be distinguised from "epigenesis" (if the old epigenesis is meant), would seem to fall but a little short of complete surrender.

PREFORMATION.

The whole question turns on what preformation meant to Bonnet. Preformation may stand for ideas that are quite distinct, or even antagonistic. As understood generally by the evolutionists of the eighteenth century, it was *the negation of all new formation.* It was the dogma of *original creation,* according to which all real formation was completed at the beginning of the world. The creative power was believed to have acted once for all, and to have since taken "Ferien," as Burdach (p. 562) expresses it. This was *syngenesis* versus *epigenesis, original* formation of all at one time in opposition to *new* formation all the time. This conception of preformation, which characterised the old evolution, has lost all scientific standing. So far the triumph of epigenesis has been complete, as all admit.

But the word preformation still has its use in an entirely different sense. We speak of the germ as the preformed foundation of the organism to which it gives rise, meaning, not that the adult form is already outlined in all its parts, but that the initial stage alone exists prior to, and different from, the stages that are to follow. In this sense preformation stands in no contradiction with postformation or epigenesis, for both are complementary phases of one development. Development begins with a minimum of preformation and increases this by every increment of postformation, until both the *pre* and the *post* are abrogated in complete formation.

The further we examine the new idea of preformation, the clearer it becomes that it differs *toto coelo* from the old notion. It does not allow that even the minimum of preformation with which development begins was an original creation. The germ is a preformation and at the same time a new formation. Germs are continually forming as the result of growth and self-division. The new germs are the pre-existing germs enlarged and divided. How the original ancestral germs arose we do not know. We find no evidence of spontaneous generation, but it does not accord with what we know to suppose that they were originally just what they are to-day. As all later stages of development are variable, we see no reason for supposing the initial stages invariable. In fact, germs must have varied, or the evolution of organisms is a myth. But the simplest germs we know grow and multiply by self-division. They do not arise agenetically like crystals, and we do not see how germs could be so simplified as to arise by chemico-physical combinations. The simplest term of the developmental series presupposes the co-existence of the fundamental powers of growth and self-division as absolutely indispensable conditions of heredity and variation. Yet we do not fall back on the rejected hypothesis of original creation. If there ever was a time when no organic elements of the nature of germs existed,—and of this we are by no means sure,—then we feel warranted in assuming that they came into existence at a stage in the evolution of the cosmos when conditions were somewhat different from those now obtaining, and that they came by the same great highway by which all things come and go—the highway of natural law.

Observe how complete the revolution in ideas. The old preformation affirmed syngenesis and denied epigenesis ; the new preformation affirms epigenesis and denies syngenesis. I do not assert that the present idea of preformation affirms all the extravagances that have usurped the name epigenesis ; but I do claim that, as now generally understood, it denies the very thing it formerly stood for, syngenesis, and presupposes and advocates the very thing it formerly opposed, generation in the sense of epigenesis. Not only is postformation, which is all there is left of the old epigenesis, maintained, but it is claimed to take place both from within and without.

More than that, everything that preformation now stands for is regarded as the product of phyletic generation—as the heritage of all past epigenesis.

Is it strange that preformation now rests on the very principles it was originally supposed to exclude? No stranger certainly than that the old evolution should die as an idea and live as a name for the antithetical idea of epigenesis. Such changes are not rare, and when comparing the doctrines of development in the eighteenth century with those of to-day, we have to be on guard against concluding from identity of names to identity of ideas. If names could be relied upon for the identification of ideas, it would be easy to make Bonnet the father of the dominant ideas of modern evolution. Bonnet held to continuity in the scale of life, but how different is continuity in *grades* from continuity in *generation* of organisms? Bonnet uses the expression "*genealogical tree*" to describe a branching community of polyps. But would any one accuse modern phylogenists, who make use of the same expression, of reverting to Bonnet's conception, into which the idea of genetic affinity did not and could not enter? The expression "cellular tissue" also occurs in Bonnet's writings, but I have never heard it intimated that Schleiden and Schwann were thus forestalled. If further illustrations were needed to show that community of vocabulary does not always imply community of ideas, an appropriate one is found in Kant's definition of epigenesis as *"generic preformation,"*[1] and another in Burdach's *"epigenetic preformation."*[2]

BONNET'S POSITION.

Having seen that preformation may stand for extremes as wide apart as the doctrine of specific creation and that of modern evolution, we will try to ascertain Bonnet's position. That he began with the first extreme is undisputed; that he could have held both extremes at the same time is impossible; that he must have abandoned the first if he ever reached, or approximated, the second, is self-evident.

We are generally told that the germ, as first defined by Bonnet, was supposed to be an exact image, or, to use Huxley's words, *"an actual miniature of the organism."* Although Bonnet's language sometimes appears, at first sight, to indicate such likeness of form, it is made clear from numerous statements that it cannot bear that interpretation. In fact, exact form-resemblance was positively denied. In those earlier meditations upon germs, recorded in the first eight chapters of the *Corps organisés*, we find already the suggestion that the germ state differs from the developed state, approaching the form and nature of a liquid globule (Chap. IV, Art. 57). In Chapter IX of the same work, but written about twelve years later (1759), Bonnet points with evident pride to the fact that he has nothing to change in his earlier views, and again dwells on the contrasts between the earlier and the later stages in respect to form and consistency (Arts. 143, 146, 154), cautioning the reader, however, against supposing that the germ ever represents a fluid in the strict sense of the word:

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[1] Since the power of reproduction is given in the organisation of the race, it may be said that in the first parents all future generations pre-existed dynamically.

[2] Differing from syngenetic preformation in not being *original.* Called "epigenetic" to indicate that the germs arise in the parent organism, at *different times*, but always *before* sexual concurrence. In the old theories of generation *prae* and *post* generally related to the prime act of reproduction. Preformation was always *complete*; postformation *gradual.*

> "On se tromperait si l'on pensait que le germe est originairement un véritable fluide. Les fluides ne sont pas organisés ; le germe l'est, et l'a été dès le commencement. Lorsqu'il s'offre à nous sous l'apparence trompeuse d'un fluide, il a des vaisseaux, et ces vaisseaux s'acquittent de leurs fonctions essentielles. Ils sont donc solides ; mais leur délicatesse extrême paraît les rapprocher de la fluidité" (Art. 154).

In the last chapter of the work, which deals with the formation of monsters, Bonnet says that the germ of the chick differs from the fœtus so greatly in form, proportions, and arrangement of parts that, if we could see it enlarged just as it is, we should not be able to recognise it as a chick :

> "Tandis que le poulet est encore dans l'état de germe, toutes ses parties ont des formes, des proportions, des situations qui diffèrent extrêmement de celles que l'évolution leur fera revêtir. Cela va au point, que si nous pouvions voir ce germe en grand, tel qu'il est en petit, il nous serait impossible de la reconnaître pour un poulet. On n'a pour s'en convaincre, qu'à relire l'Art. 146. Le poulet étendu alors en ligne droite, ne présente, comme le ver spermatique, qu'une grosse tête et une queue effilée, qui renferme les ébauches du tronc et des extrémités. . . . Enfin, toutes les parties du germe ne se développent pas à la fois et uniformément." (Part II, Chap. VIII, Art. 351, p. 508. Tableau prefixed to *Palingénésie*, Art. 15, pp. 67, 68.)

It is thus made quite certain that Bonnet did not regard the germ as a photographic image of the adult form, and that idea must be put entirely aside if we would see just what is strictly essential in his conception of preformation.

The essential thing, as we shall see, was the pre-existence of the organism with all its parts completely formed, though not definitively shaped. Development could not form anything new, but it could modify shape and proportions very considerably. The ears, for example, in the germ of the horse were supposed to pre-exist as actual ears, but in what shape and proportions Bonnet never undertook to say. *All his theory required was that they should be present as perfect original creations, admitting of no differentiation or modification in their essential nature.* They must have shape, but not the particular shape presented in the adult state. The Creator had so designed them that, under normal conditions of development, they would expand into the form peculiar to the species. Slight variations of those conditions in the first stages might enlarge these organs to the dimensions exhibited in the mule, or transform them to monstrous shapes, or even prevent their unfolding at all.

In organs conceived as infinitesimal "organic points," shape, size, proportions, signified nothing. Pre-existence of everything truly organic was the all-essential thing. Pre-existence, precluding all generation and regeneration, reducing all metamorphosis to simple change of external form, leaving no place for growth, differentiation, heredity, variation, or multiplication of individuals or species,—that was the preformation contended for by Bonnet. To be sure, Bonnet had much to say about fertilisation, assimilation, growth, heredity, and other general phenomena of development; but every one of these things was treated as extra-organic, and as purely mechanical means for expanding, without increasing, the original organic framework. All these things appear to go on; but our senses deceive us. They cannot go on at all, according to Bonnet. A mask of falsehood obscures the whole face of nature. Development is a complete illusion; for what appears to arise only emerges from a state of invisibility to one of visibility. Bonnet says:

> "It is not necessary to suppose that the germ has all the features which characterise the mother as an individual. The germ bears the original imprint of the species, and not that of the individuality. It is on a small scale a man, a horse, a bull, etc., but it is not a certain man, a certain horse, a certain bull, etc. *All germs are contemporaneous in the system of evolution, they do not communicate to one another their features, their distinctive characters.* I do not say that all those of the same species are exactly alike. I see nothing identical in nature; and without recourse to the principles of *indiscernibles*, it is very clear that all germs of the same species do not come to develop in the same womb, at the same time, in the same place, in the same climate, in a word, under the same conditions. Such are many of the causes of variation." (*Corps organ.* II, Chap. VII, Art. 338, pp. 462, 463.)

But none of these causes of "variation" strike deep enough to change the essential foundation of the organism. Variations disguise the organism, without effecting any real change in its essential parts.

> "The soil, cultivation and other special conditions, may influence the proportions and certain characters, so as to make it difficult to recognise the species. Here will be a dwarf, there a giant. Do not allow yourself to be imposed upon thereby;

bring them both to close examination, and you will be able to discover the species in the midst of these deceptive appearances. The forms may likewise change, and disguise the species still more ; redouble your attention, and you will recognise the disguise." (*Contemplation*, I, Part VII, Chap. XII, p. 295.)

We meet with this idea of the immutability of species at every turn, in both the earlier and later writings of Bonnet. In the eighth chapter of the *Corps organisés* (p. 90) we read :

> "Nature is assuredly admirable in the conservation of individuals ; but she is especially so in the conservation of species. . . . No change, no alteration, perfect identity. Species maintain themselves victoriously over the elements, over time, over death, and the term of their duration is unknown."

In the same chapter (p. 89) Bonnet says :

> " We cannot doubt that the species which existed at the beginning of the world, were no less numerous than those which exist to-day. The diversity and the multitude of combinations, perhaps also the diversity of climates and of foods, have given rise to new species or to intermediate individuals. These individuals uniting in their turn, the shades have multiplied, and in multiplying become less noticeable. The pear-tree among plants, the common fowl among birds, the dog among quadrupeds furnish striking examples of this truth."

Here Bonnet speaks in language befitting modern evolution of "new species," the very thing so positively denied. This manner of self-contradiction is habitual, and there is not the least inconsistency in it. Bonnet describes *appearances*, and he expects the reader to remember, what he has so often repeated, that appearances are deceptive. In many instances he uses the language of modern evolutionary doctrines without having any conception of them, and carrying always ideas that contradict them.

BONNET'S PREFORMATION AN INCORRIGIBLE NEGATION.

This preformation theory, contradicting appearances at every point, seemed to Bonnet and many other eminent men of the eighteenth century to magnify the glory of the Creator. To us it seems to be scepticism towards all nature, crystallised into a colossal system of inflexible negations, each involving the others, and all involved in one capital negation : NO ESSENTIAL CHANGE IN THE ORGANIC UNIVERSE.

The discovery of a single flaw in this all-embracing negative would put the whole theory in the light of a "romance," as Bonnet himself repeatedly declared. In one of the last of the many supplementary notes to the final revision of the *Corps organisés* (1779), Bonnet reaffirms this negative as a fundamental principle to which he had always firmly adhered. The note begins with the following warning from Haller:

> "Observe that it is very dangerous to concede the formation of a finger by accident. If a finger may thus form itself, then a hand, an arm, a man, will do the same."

To this Bonnet replied:

> "You are right; I have insisted upon that point a hundred times. I came to that conclusion long before you, when you supposed it possible for *une glu se figer et s'organiser*, and when epigenesis pleased you most. (*Corps org.*, Art. 155.) But observe, in your turn, that I have never attributed the *formation* of the least thing to *accident*. I have always conceded and maintained the preformation of everything that is truly *organic*. M. de Mairan made the same remark to me as yourself, and he received the same response. His objections against the sixth finger relate only to the graft of Lemery. I have not appealed to ingraftment; I have merely questioned if accidental causes might not have separated one or more fingers while they were yet in a gelatinous or nearly fluid state. In a word,—*and can I repeat it too often?*—I have never conceded anything but simple modifications of preformed parts, except certain cases of grafts or accidental separations." (*Corps org.*, p. 543.)

Such was Bonnet's testimony in 1778, while engaged in the final revision of his works, over thirty years after putting his first meditations on generation into manuscript (1747), and about ten years after concluding his system of philosophy in the first edition of the *Palingénésie philosophique* (1769). It was his testimony after a prolonged consideration of that greatest of stumbling-blocks to the evolutionist, the *propagation of monsters*. Although finally forced to admit that sex-digitism could be transmitted by either sex (p. 536), Bonnet maintained his position as firmly as ever, only hesitating to pronounce decisively between the hypothesis of originally monstrous germs and that of accidental causes. On this point he could close his volume with, "*fiat lux*," but on the main thesis,—*all preformation, no generation*,—he had chained himself irrevocably, and left himself no possible escape.

The same incorrigible negation meets us in Haller's dictum: "*Nulla adeo est epigenesis.*" To Bonnet it remained to the end the alpha and omega of philosophy and the sheet-anchor of religious faith. Let one example suffice:

> "A true philosopher would not undertake to explain mechanically the formation of a head, an arm, however simple might be the structure of this head or this arm. In the most simple organic structure there are still so many relations; these relations are so varied, so direct; all the parts are so intimately connected, so dependent on one another, so co-operative to the same end, that they could not be conceived of as having been formed one after the other and arranged successively, like the molecules of a salt or a crystal. A sound philosophy has eyes that discover in every organised body the ineffaceable imprint of a work done at a single stroke, and which is the expression of that Adorable Will that said, '*Let organic bodies be, and they were.*' They were from the beginning, and their first appearance is what we very improperly call *generation, birth.*" (*Contemplation*, Part IX, Chap. I, p. 2.)

After wrestling with all the perplexing questions presented in Hydra; after accounting for sex as a means of diversifying the unity of the *beau physique*, and sexual reproduction as a device for expanding the germ and preserving regularity of specific form; after reconciling the existence of varieties with the permanence of species; after contending that a mule is a disguised horse and a hinny a disguised ass, and that the sterility of hybrids is to be regarded as fertility kept dormant by lack of adequate means to unfold; after reducing all heredity to likeness of original, contemporaneous, and independent creations, unfolding under similar conditions; after elaborating a scheme of "natural evolution" broad enough to take in any number of cosmic revolutions, and provide for the ultimate perfection of every organism as an immortal being;—in a word, after setting "Ferien" to all creative activity, Bonnet resolutely undertook to devise a scheme that would keep the holiday repose forever inviolable. With a zeal never daunted, and an ingenuity seldom baffled, never defeated, he piled mountain upon mountain of negation, rolling Ossa on Olympus and Pelion upon Ossa, until the whole organic world seemed to be completely buried under a stupendous mass of negations, blending in one infinite negation—NO CHANGE.

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